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(71) Applicant (for all designated States except US): **4D TECHNOLOGY SYSTEMS LIMITED** [GB/GB]; The Rookery, Highgate Works, Forest Row, East Sussex RH18 5AT (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **BUSTAMANTE, Eugenio** [GB/GB]; The Rookery, Highgate Works, Forest Row, East Sussex RH18 5AT (GB).

(74) Agent: **BARKER BRETTELL**, 138 Hagley Road, Edgbaston, Birmingham B16 9PW (GB).

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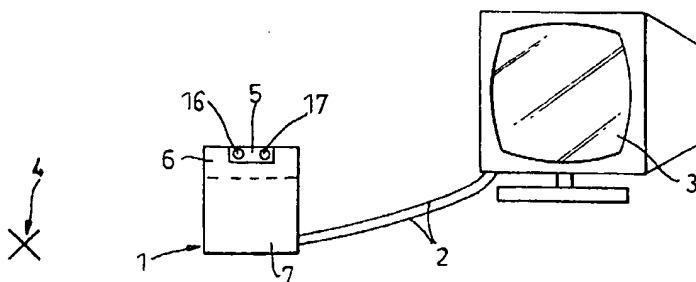
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(54) Title: CONTROLLING ELECTRONIC DEVICES



(57) Abstract: A means for controlling an electronic device (1) comprises a control member (4) adapted to be held and moved in space by a user. The control member (4) has at least one characteristic (12, 13, 14, 15) enabling its orientation in space to be determined. A camera means (5) detects the position of the control member (4) with respect to time and analysing means (6) analyses the positional information to ascertain the movement of the control member (4). Control signal generating means (7) generates control signals for the electronic device (1) in response to the analysed movement of the control member (4). The means can replace a conventional joystick or keypad, and is particularly useful for controlling games consoles and the like.

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## CONTROLLING ELECTRONIC DEVICES

This invention relates to means for controlling electronic devices such as games consoles or the like.

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Conventionally such electronic devices are controlled by a joystick or keypad, usually integrated into the device. The device may have an integrated display screen, or be connected to a separate display monitor, which displays the game being played. Movement of the joystick or depression of buttons on the keypad sends control signals to the device. One disadvantage of the joystick and the keypad is that they may not be easy to use, especially for users with disabilities affecting the fine motor control of the hands.

15 According to the present invention, a means for controlling an electronic device comprises a control member adapted to be held and moved in space by a user, and having at least one characteristic enabling its orientation in space to be determined, a camera means for detecting the position of the control member with respect to time, means for analysing the positional information to ascertain movement of the control member, and means for generating control signals for the electronic device in response to the movement of the control member.

25 The position of the control member at any point in time is detected by the camera means. The orienting characteristic on the control member means that movement can be deduced from the positional information and translated into control signals for the device. The control member has a greater freedom of movement than the normal joystick or keypad. For example, it can be moved bodily in space up or down, side to side, and towards or away from the camera means. It can also be rotated. Each of these movements can be detected and used to generate control signals for

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the device. Where the device is a games console, different movements can be used to move a character and perform other functions such as selecting a mode of firing a weapon. The control member is easy to use, as it does not rely significantly on fine motor control.

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The control member may comprise at least two spokes radiating from a central axis, with at least one spoke having an orienting characteristic. Preferably four spokes are provided, although there could be as many as eight.

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The orienting characteristic is preferably provided on the outer end of at least one spoke. Preferably, the orienting characteristic comprises at least one distinguishing shape or mark. Each orienting characteristic may comprise a mark such as a cross, circle, triangle or square. The orienting  
15 characteristic may be the shape of the spoke. For example, one spoke could be longer than the rest, or of a different outline. Different colours may also be used as well as other distinctions.

20

The outer ends of the spokes may be joined by a ring. The control member may also include a handle on its rear side.

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The preferred control member with four spokes enables rotation of the control member about the central axis (i.e. in the plane of the spokes) to be detected, as well as inclination of the spokes to the plane.

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Conveniently, the analysing means use algorithms to deduce the movement of the control member from the positional information acquired by the camera means. The analysing means may be executed as software, or hardware such as microprocessors.

The signal generating means uses the movements analysed by the analysing means to generate appropriate control signals for operating the device. The generating means is preferably executed as software. It may generate signals which emulate those of existing game consoles, enabling  
5 the control member to be used with existing game consoles.

The camera means preferably comprises a stereoscopic camera array, having a pair of pinhole cameras whose optical properties are known. The images from the two cameras are combined to provide an accurate  
10 representation of the position of the control member in space, so that its movement can also be accurately analysed.

Alternatively, one camera may be used. Again, its optical properties are known. With one camera, movement towards and away from the camera  
15 is more difficult to analyse than with two. However, large movements towards or away from the camera can be detected, by looking at the change in surface area, and comparing the current dimensions of the control member with those for a given distance from the camera, which will be known. The other movements (up or down, side to side, rotation  
20 and inclination) can be determined accurately by comparing the camera image with an ideal image of the control member at a fixed position.

Preferably, the analysing means stores the size and shape of the control member. This enables more accurate analysis of the movement of the  
25 control member to be made. The camera image can be compared with the stored ideal image to determine the location and orientation of the control member.

The camera means and the analysing and generating means are preferably  
30 combined into a single unit. This may be integrated into a games

console. The camera means and the analysing and generating means may be separate and adapted to be joined to a console by appropriate leads.

Various embodiments of the invention are illustrated, by way of example  
5 only, in the accompanying drawings in which:

**Figure 1** is a schematic illustration of a control means for an electronic device;

10 **Figure 2** shows the control member in detail;

**Figure 3** is similar to Figure 1, but shows a modification; and

**Figure 4** shows a modified control member.

15

Figure 1 shows a schematic view of a means for controlling an electronic device such as a games console 1. The games console 1 is connected by appropriate leads 2 to a monitor 3 on which the game being played is displayed.

20

The control means has a control member 4 which is held and moved in space by a user (not shown) and has characteristics enabling its orientation in space to be determined. A camera means 5 detects the position of the control member 4 over time, analysing means 6 analyses  
25 the positional information to ascertain the movement of the control member 4, and generating means 7 generates control signals for the device 1 in response to movement of the control member 4.

The control member 4 is shown in more detail in Figure 2. It comprises  
30 a plastics member having four spokes 8, 9, 10, 11 radiating in a cross-shape from a central axis A. Each spoke has on its respective outer end

of its front face an orienting characteristic 12, 13, 14, 15. The orienting characteristics are a different colour from the spokes, and each has a different shape. In this case they are a cross, a square, a triangle, and a circle, but it will be appreciated that any suitable shapes could be used.

5 The control member 4 also has on its rear face a handle (not shown) by which it can be held by the user.

The control member 4 can be moved bodily in space, and relative to the camera means 5, in the following ways: up or down, side to side, and

10 towards or away from the camera means 5. In addition, it can be rotated about its central axis A (in the plane of the spokes 8, 9, 10, 11) or inclined to that plane.

The camera means 5 detects the position of the control member 4 as it is moved. The camera means 5 is mounted on the console 1, and comprises

15 a stereoscopic camera array of two pinhole cameras 16,17 whose optical properties are known. The images from the cameras 16, 17 are analysed by the analysing means 6, to ascertain the movements of the control member 4.

20 The analysing means 6 is integrated into the console 1 and is executed as hardware, such as a microprocessor, although it may be provided as software. The analysing means 6 receives the images from the cameras 16, 17, and processes these to determine the position and orientation of

25 the control member 4 at any given time. The use of the stereoscope camera array means that the location of the control member 4 in space can be determined absolutely. The analysing means 6 uses suitable algorithms to process the images, and holds an ideal image of the control member 4 at a given distance from the camera means 5 and with a given

30 orientation, to assist in the processing. Comparison of one set of images with the previous one is used to determine movement. Thus, changes in

the position of the orienting characteristics in the plane of the spokes are used to determine the up or down and side to side movement of the control member 4, while changes in their size are used to determine the towards and away movement. Angular movement of at least two of the  
5 orienting characteristics is used to determine rotation, and changes in their shape determine inclination.

The movement ascertained by the analysing means 6 is used by the generated means 7 to provide control signals for the console 1. The  
10 generating means 7 is integrated into the console 1, and is executed as software. The generating means 7 assigns each movement (as described above) a particular command to the games console 1 - for example movement of a character in the game, selection of a mode or the firing of a weapon. The ability to rotate the control member 4 is particularly  
15 useful when the game simulates the driving of a vehicle.

Thus, simple movements of the control member 4 can be used to send control signals to the games console 1, ensuring ease of use.

20 Figure 3 shows a modification, where the games console 1 is separate from the control unit 20. In Figure 3 the camera means 5, analysing means 6 and generating means 7 are all housed in the control unit 20, which is connectable to the games console 1 by appropriate controller leads 21. The generating means 7 are arranged to generate control  
25 signals which emulate those of an existing game controller (not shown), such as a joystick or keypad.

Further, in Figure 3 the camera means 5 comprises a single camera 22. This, naturally, does not provide as much information as the pair of  
30 cameras 16, 17 of Figure 1; as the position in the towards and away from camera direction is more difficult to detect. However, the camera image

can be compared with the ideal image, and the difference in the surface area and size will give a good approximation of towards/away from distance. The other movements can be determined accurately by comparison with the ideal image, and comparison of one camera image with a previous one. Otherwise, the embodiment of Figure 3 is the same as that of Figure 1.

Figure 4 shows another embodiment of the control member 4, in which a ring 23 connects the outer ends of the spokes 8, 9, 10, 11. Otherwise the member 4 of Figure 4 is the same as that of Figure 2, and corresponding reference numerals have been applied to corresponding parts. The ring 23 has advantages as it provides a further comparison item for processing of the image.

It will be appreciated that the control member 4 could be modified in other ways (not shown). For example, only one spoke need have the orienting characteristic, but more orienting characteristics increases accuracy. Alternatively, the spokes could be of different shapes, so that the shape provides the orienting characteristic. While the control members 4 shown have four spokes, any number from two to eight would be possible. Whatever the size and shape of the control member 4, its dimensions must be held in the analysing means 6 to enable the analysis of its movements to be made.

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## CLAIMS

1. A means for controlling an electronic device (1) comprises a control member (4) adapted to be held by a user, characterised in that the control member (4) is adapted to be moved in space, and having at least one characteristic (12,13,14,15) enabling its orientation in space to be determined, a camera means (5) for detecting the position of the control member (4) with respect to time, means for analysing (6) the positional information to ascertain movement of the control member (4), and means for generating control signals (7) for the electronic device (1) in response to the movement of the control member (4).
2. A means for controlling an electronic device as claimed in claim 1, characterised in that the control member (4) comprises at least two spokes (8, 9, 10, 11) radiating from a central axis (A) with at least one spoke (8, 9, 10, 11) having an orienting characteristic (12, 13, 14, 15).
3. A means for controlling an electronic device as claimed in claim 2, characterised in that the control member (4) comprises four spokes (8, 9, 10, 11) radiating from a central axis (A) with at least one spoke (8, 9, 10, 11) having an orienting characteristic (12, 13, 14, 15).
4. A means for controlling an electronic device as claimed in claim 2 or claim 3, characterised in that the orienting characteristic (12, 13, 14, 15) of the control member (4) is located at an outer end of at least one spoke (8, 9, 10, 11).
5. A means for controlling an electronic device as claimed in any preceding claim, characterised in that the orienting characteristic (12, 13, 14, 15) of the control member (4) is at least one distinguishing shape or mark (12, 13, 14, 15).

6. A means for controlling an electronic device as claimed in claim 2 or claim 3, characterised in that the orienting characteristic (12, 13, 14, 15) of the control member (4) is the shape or size of at least one spoke (8, 9, 10, 11).

7. A means for controlling an electronic device as claimed in any of claims 1 to 3, characterised in that the orienting characteristic (12, 13, 14, 15) is the colouring of the control member (4).

10

8. A means for controlling an electronic device as claimed in any of claims 2 to 7, characterised in that the spokes (8, 9, 10, 11) of the control member (4) are joined by a ring (23).

15 9. A means for controlling an electronic device as claimed in any preceding claim, characterised in that a handle is provided on the rear side of the control member (4).

20 10. A means for controlling an electronic device as claimed in any preceding claim, characterised in that the analysing means (6) uses algorithms to deduce the movement of the control member (4) from the positional information acquired by the camera means (5).

25 11. A means for controlling an electronic device as claimed in any preceding claim, characterised in that the analysing means (6) is executed as software.

30 12. A means for controlling an electronic device as claimed in any preceding claim, characterised in that the analysing means (6) is executed as hardware.

13. A means for controlling an electronic device as claimed in any preceding claim, characterised in that the signal generating means (7) uses the movements analysed by the analysing means (6) to generate appropriate control signals for operating the electronic device (1).

5

14. A means for controlling an electronic device as claimed in claim 13, characterised in that the control signal generating means (7) is executed as software.

10 15. A means for controlling an electronic device as claimed in any preceding claim, characterised in that the camera means (5) comprises a stereoscopic camera array, having a pair of pinhole cameras (16, 17) whose optical properties are known.

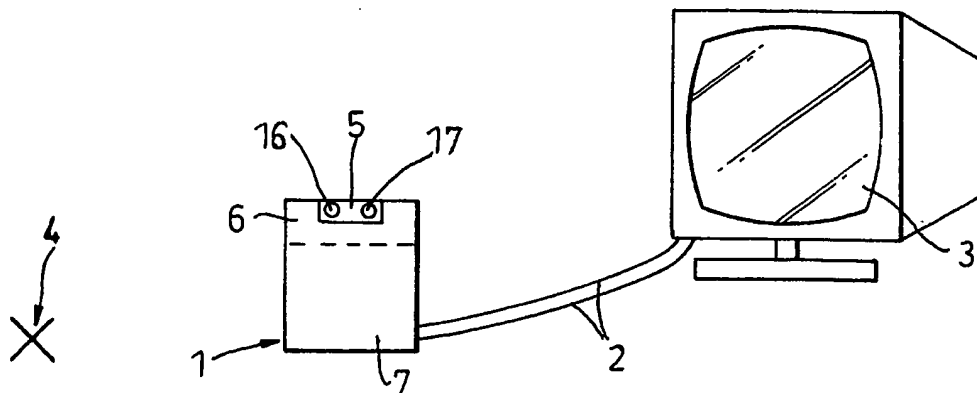
15 16. A means for controlling an electronic device as claimed in any preceding claim, characterised in that the camera means (5) comprises a single camera (22) whose optical properties are known.

17. A means for controlling an electronic device as claimed in any  
20 preceding claim, characterised in that the analysing means (6) stores the size and shape of the control member (4).

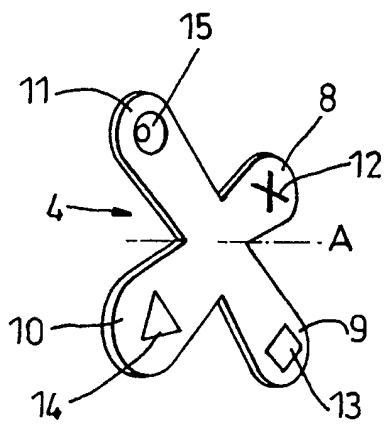
18. A means for controlling an electronic device as claimed in any  
25 preceding claim, characterised in that the camera means (5) and the analysing (6) and generating means (7) are combined into a single unit and integrated into a games console (1).

19. A means for controlling an electronic device as claimed in any  
30 preceding claim, characterised in that the camera means (5) and the analysing (6) and generating means (7) are separate and adapted to be joined to a games console (1) by appropriate leads (21).

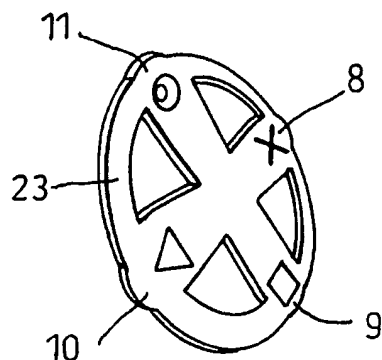
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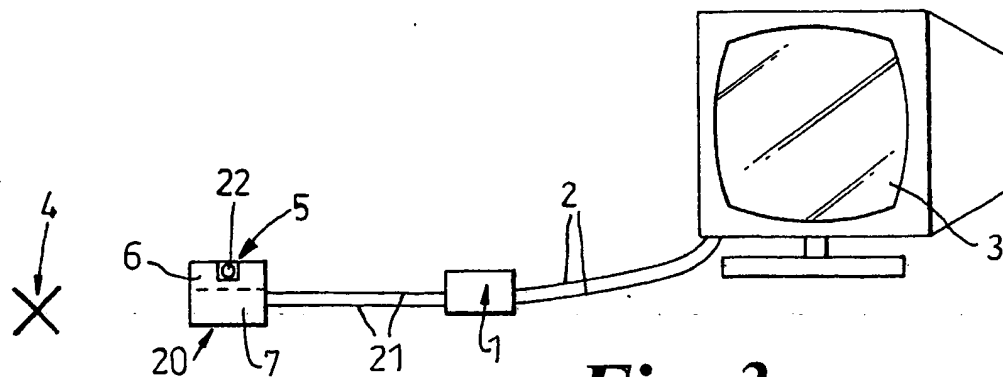
**Fig. 1**



**Fig. 2**



**Fig. 4**



**Fig. 3**

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